Ontario

Ministry of
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Highway
Engineering
Division

Engineering
Materials
Office

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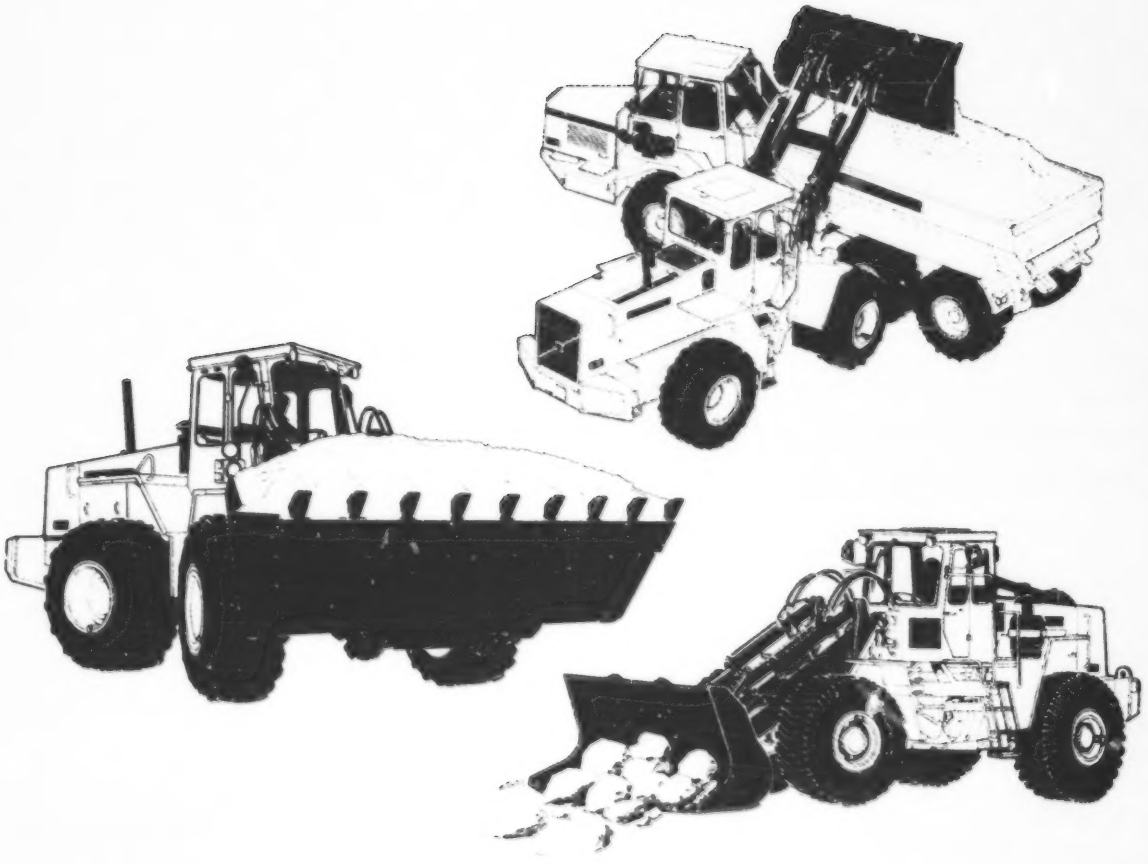
Provincial Highways

GUIDELINES FOR SAMPLING OF GRANULAR MATERIALS FOR ACCEPTANCE PURPOSES



Ontario

Ministry of Transportation and Communications

Engineering Materials Office

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Provincial Highways

GUIDELINES FOR SAMPLING OF GRANULAR MATERIALS FOR ACCEPTANCE PURPOSES

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GUIDELINES FOR SAMPLING OF GRANULAR MATERIALS FOR ACCEPTANCE PURPOSES

1.0 INTRODUCTION

The purpose of these guidelines is to outline revised field procedures for sampling of granular materials for acceptance purposes.

These revised procedures are to be instituted when the contract documents require the contractor to construct the stockpile in layers, and make available the completed sublot for sampling on a random area basis.

The first version of EM-67, issued in January, 1983, also included guidelines on field testing requirements since the appropriate Ministry testing procedure, LS-602, did not fully address field test requirements. Recently, this laboratory testing procedure has been updated to include field test requirements, and, therefore, the testing aspect is not included in this revised text.

2.0 SAMPLING LOCATION

Aggregates composed of mixtures of different sized particles will separate or segregate if processed and/or handled in an unacceptable manner. For this reason, samples taken for testing of gradation should be obtained at the last practical point before the material is incorporated into the finished work. However, recent studies have shown that, if stockpiles are constructed in an acceptable fashion (i.e. using a layer construction method), then random samples obtained during construction of the stockpile will show a high degree of correlation with random samples obtained on the road.

The acceptable locations for sampling are:

1) From existing stockpiles containing less than 4 000 tonnes of material;

2) From stockpiles during their construction, provided the contractor fulfills the following requirements:

   a) constructs the stockpile according to the first three paragraphs of Subsection 1000.09.05 of M.T.C. Form 1000, or Subsection 1001.07.05 of O.P.S.S. 1001;

   b) builds the stockpile in layers;

   c) places each sublot to a thickness of less than 1 m;

   d) makes each sublot available for sampling after processing for that entire sublot is completed;

   e) does not spill material over the edges of the stockpile.

3) At the location and time of loading the delivery vehicles (Delivery Sampling).

4) From the road (Road Sampling).

The actual location of sampling will be determined by the Engineer. The general rule is that, provided the stockpile operations outlined above are followed, then sampling during construction of the stockpile will be carried out. However, there are a number of exceptions to the general rule when delivery or road sampling will be carried out, regardless of how the stockpile is constructed. These exceptions relate primarily to cases where there is no guarantee that the material stockpiled and tested will be the same as the material placed on the road. The exceptions are as follows:

a) Where the material is from a commercial source with several stockpiles or several pit faces.

b) Where the material comes from several sources of supply to one contract, making sampling at the source impractical.

c) Where a commercial source is supplying to other customers, and has a record of selling material, tested by ourselves, to others.

d) When the contractor is loading material directly from a crusher or from a small storage bin, and there is no practical means of obtaining proper samples before delivery of the material to the road.

e) Where a front-end loader is not made available for sampling at the source.

When sampling during stockpiling is not carried out as in the exceptions outlined above, or because of improper stockpiling operations, then road or delivery sampling will be implemented. The choice between road or delivery sampling is made on the basis of practicality. For instance, road sampling would be implemented if the field lab is closer to the road than to the source. On the other hand, delivery sampling would be carried out if the material is to be placed in various locations in small quantities or on the road in very thin lifts. When delivery or road sampling will be carried out, the contractor shall be advised in writing.

Occasionally, the contractor or his supplier will indicate that, in his opinion, the sampling or testing of granular materials is not being carried out in accordance with the contract and/or with Ministry policy. If this occurs, the contractor can write to the Regional Manager of Construction detailing the concerns. The Manager will initiate an investigation, and discuss the concerns with the Contract Management Office and the Engineering Materials Office before responding to the contractor.

3.0 FREQUENCY OF SAMPLING

The frequency of sampling is governed by the size of the lot since the lot is divided into four equal sublots, and one sample is obtained from each sublot.

The definition of a lot is a specific quantity of material that is produced by the same process.

The choice of the lot size is left to the discretion of the Project Supervisor, however, the lot size must not be greater than 4 000 t during the early stages of production. After four consecutive lots have been accepted at the contract price, the Project Supervisor may increase the lot size to 10 000 t for Granular A and M, and to 20 000 t for Granular B.

Increasing the lot size should be reserved for those exceptional cases where the source has a historically consistent gradation.

If a lot which has been increased in size is rejected or its payment adjusted, the next lot must be decreased to a maximum of 4 000 t, and the lot size not again increased until four consecutive lots have met the specification requirements. The contractor should be advised in writing prior to increasing or decreasing the lot size.

Since each lot is decisioned separately for acceptance, rejection or adjusted payment, it is necessary to record the quantities in each lot. The weigh tickets provide an excellent record, and should be used for this purpose where possible. Otherwise, the contractor's production rate as determined by the Project Supervisor could be used as a basis for estimating the quantities.

4.0 RANDOM SAMPLING PROCEDURES

4.1 Random Number Tables

Random sampling means choosing samples in such a manner that each portion in the lot has an equal probability of being selected.

Random Number Tables must be used to carry out random sampling. The Random Number Tables to be used are those generated by the Ministry's main computer. Tables are included on the pad of forms of Granular Gradation Computation, Acceptance and Payment Adjustment Sheet; additional tables are available through the Regional Quality Assurance Section. The tables are set up in groups of four numbers; each is a three digit decimal. An example of random number tables are given in the Appendix. In the tables, the decimal numbers are grouped in sets of four to facilitate their use for four tests per lot. In selecting numbers, a pencil or pen should be stabbed onto a sheet of random numbers with the eyes closed. The group of numbers closest to the location should be chosen for the first lot. Successive random numbers should be picked by following a systematic pattern until all the numbers are used. If more random numbers are required, the above procedure should be repeated, using another table.

The random numbers used for each lot should be recorded in a sampling diary.

4.2 Random Sampling on Time Basis

This method will apply only to road and delivery sampling when it is more practical to estimate the time it will take the contractor to load, or to deliver to the work, the quantity of aggregate representing a lot.

If, for instance, it is estimated that during the following two days the contractor will load or deliver about 3 000 t of the particular material, this time may be used as a lot. One sublot, thus, will contain 750 t. If the working time in two days is, say, 16 hours, one sublot will take about four hours or 4 x 60 = 240 minutes. The two days will then be divided into the four sublot times as follows: FIRST DAY 8 am to 12 noon = first sublot; 1 pm to 5 pm = second sublot; SECOND DAY 8 am to 12 noon = third sublot; 1 pm to 5 pm = fourth sublot. In this example, a one hour down time (lunch) between 12 noon and 1 pm has been assumed.

By the method described earlier, the Inspector selects a group of four random numbers,

and each of these numbers is multiplied by the time in minutes required for one sublot, in this case, 240 minutes. Since all random numbers are decimal digits, the products of the multiplication will always be less than the total time of one sublot. The four products are added to the starting times of each sublot, giving the random times for the samples. In our example, if the random numbers picked were: .584, .216, .233 and .805, the products and the actual sampling times will be as follows:

Sublot	Calculations	Sublot Starting Time	Sampling Time
1st	.584 x 240 = 140 min.	8 am	10:20 am
2nd	.216 x 240 = 52 min.	1 pm	1:52 pm
3rd	.233 x 240 = 56 min.	8 am	8:56 am
4th	.805 x 240 = 193 min.	1 pm	4:13 pm

The samples should be taken as close as possible to the times calculated.

The above method will be fairly easy in the case of continuous, uninterrupted haulage. When the delivery is intermittent or irregular, which is often the case, it will be difficult to predetermine the time necessary to load or to deliver the material for one lot. In this situation, the time of a lot should be estimated by assuming a frequency of loading that would not likely be exceeded.

Let us assume that, with irregular delivery, there will not likely be more than 2 000 t delivered in one day. The lot size then can be established as two days delivery. By the method explained earlier in this section, the random times for sampling should be calculated, preferably for more than one day (for the whole week, if practical). Now at the time of sampling, the Inspector arrives at the appropriate place, and, if there is no truck at the determined time, or within a reasonable waiting period, he may skip one sample, and extend the time for the lot accordingly. If this practice is employed, we must be sure that the actual size of the lot will never be larger than the allowable maximum size of 4 000 t. After the sampling and testing is completed, the actual lot size must be determined by computing, from the weigh tickets, the quantity of material delivered for the applicable time period.

4.3 Random Sampling on Quantity (Tonnage) Basis

This method is applicable to road or delivery sampling only. In those situations when it is simpler to determine the lot size by the number of truck loads, random samples may be selected according to the truck load. This method will require close communication between the sampler and the weighman and checker, especially if delivery is intermittent. Even if the weighman is an employee of the contractor, close communication with him should not present a problem.

The procedure for this sampling plan is:

Determine how many truck loads are required to haul the aggregate representing one lot. If the maximum size of the lot of 4 000 t is used, and the average load of a truck is 30 t, then one lot will consist of roughly 132 truck loads. The sublots will also be determined by the number of truck loads so that the first sublot is represented by the first 33 truck loads, the second by truck loads 34 - 66, the third by 67 - 99, and the fourth by 100 - 132. Now the random numbers will be multiplied by the number of truck

loads in a sublot to establish the particular truck load from where the random sample should be obtained. Assuming that the random numbers are: .217, .181, .721, and .347, the computation is:

Sublot	Calculations	Last Truck In Previous Sublot	Truck Load To Be Sampled
1st	.217 x 33 = 8th truck load	+0	8th
2nd	.181 x 33 = 6th truck load	+33	39th
3rd	.721 x 33 = 24th truck load	+66	90th
4th	.347 x 33 = 12th truck load	+99	111th

(Always round the decimal up to the next truck load.)

In the case of road sampling, the sample will be collected from the truck load after it is placed in the work, but prior to compaction. For delivery sampling, the sample will be obtained as the randomly selected truck is loaded. As in the case of Random Sampling on Time Basis, the actual lot size should be determined from weigh records.

4.4 Random Sampling on Area Basis

This method must be used for sampling during stockpiling to establish the sampling location within the levelled sublot. This method will also be used for road sampling to determine the location of the sample within the area of the spread truck load. For delivery sampling and sampling during the construction of a stockpile, the random area method will be used to define the location within the bucketful, levelled by the front-end loader, where the sample will be obtained. See Figure 2 for an illustration of this method.

The exact location of a sample within a certain area should be determined by two random numbers picked from a Random Number Table.

As an example, let us take the case where road sampling was decided upon, and the selected truck placed Granular A aggregate in a road widening. The load was placed 2 m wide, 45 m long, with an uncompacted thickness of 150 mm. The two random numbers chosen are: .406 and .035. The first number will be used to determine the longitudinal distance from the beginning of the spread material, and the second number will be used for determine the offset from the edge of the layer. The calculation is:

The sample location = .406 x 45 = 18.3 m from the start of spread, and
.035 x 2 = 0.07 m from edge.

5.0 SAMPLING TECHNIQUES

5.1 General

Whether stockpile, delivery or road sampling has been chosen by the Engineer, the actual procedure for obtaining a sample must be strictly adhered to.

All samples must be taken and submitted for testing by authorized personnel of the Ministry.

When sampling aggregates for gradation testing, the following equipment is required:

- Tile spade with attached side walls,
- Sample bags free of particles from previous sample,
- Sample data sheets and tags, and
- Tape measure.

Sampling techniques explained in the next paragraphs apply to one sample (sublot), and must be repeated four times to complete a lot. It is important that stockpile, delivery or road samples are not mixed within one particular lot, unless there is no other way to complete the lot, or where necessary when retesting a lot.

5.2 Sampling During Stockpile Construction

Stockpile samples must be taken from the levelled area of the stockpile after all processing for the sublot is complete. The contractor must level off the sublot, notify the Ministry that his processing is complete, and make available the area for sampling. The contractor is not permitted to place additional material on the sublot until after the Ministry has obtained the sample. To minimize delays to the contractor, as well as to the Ministry, the anticipated maximum production rate should be used as a basis for estimating sublot completion times. For instance, if the estimated maximum production rate is 250 t/hour, then, every four hours, the contractor should level off the material placed, and the Ministry Inspector should obtain the sample. Co-operation and co-ordination of activities by both parties will be required to ensure minimum delays, especially in locations where the space available for stockpiling is limited.

The random area method must be used, first, to obtain the location within the levelled sublot from where the front-end loader will obtain the material to be sampled; and, second, to determine the location within the area of the material placed and levelled by the front-end loader, from where the actual sample is to be taken.

It is a requirement of stockpile sampling that a front-end loader be used to obtain the sample. The front-end loader will be required to dig as close as practical to the full depth of the levelled sublot at the location indicated by the random numbers. This material is then levelled by blading it with the bucket to a height of between 0.3 to 0.5 m. The contractor should not be permitted to rework this load of material.

Obtain the sample, from the location determined by random numbers within the levelled bucketful, by excavating the material as deep as possible with the tile spade, making sure that the sample is not mixed with the underlying material.

If the contractor insists that our sampling and testing of the stockpiled material is not representative of the material in the stockpile, he has the option to request that we test his product by means of delivery or road samples, as long as he pays the cost of sampling and testing to date.

5.3 Road Sampling

Road sampling is performed after the aggregates have been placed and spread, but prior to compaction. Either the random time method or the random quantity method may be used to select the portion of aggregate to be sampled. In the case of random time, the sample shall be taken from the material of the first truck arriving after the calculated time. The exact location of the sample from the spread truck load should be determined by the random area method, by measuring out the longitudinal position and the offset distance indicated by the random numbers.

Take the sample from the designated area outlined by using the sample bag as a template. Always place the bag so that the longer side is at right angles to the direction in which the truck was moving. If the random numbers fall too close to the edge, then sample from the edge towards the middle of the dumped area.

Obtain the sample by lifting the material with the tile spade from the full depth of the layer, being careful not to include any material from the underlying layer. However, for thin layers, it may be necessary to increase the size of the template. Do this by staying parallel to the original template lines.

Never shake or jiggle the spade to remove excess material when filling the sample bag, because this may eliminate mainly the coarse portion of the sample.

No attempt must be made to select or avoid obvious areas where segregation, dirt or any other fault in the material may be evident. The sample must be taken where the random numbers direct. If the contractor is placing material in a manner which does not allow road sampling, then he will either have to change his method of operation or another sampling location will have to be selected.

While the Inspector is establishing the exact position of the point where the sample is to be taken and, while taking the sample, the contractor must stay clear of the area. The area has to be undisturbed by any equipment until the sample has been taken.

Road sampling is shown in Figure 1.

FIGURE 1

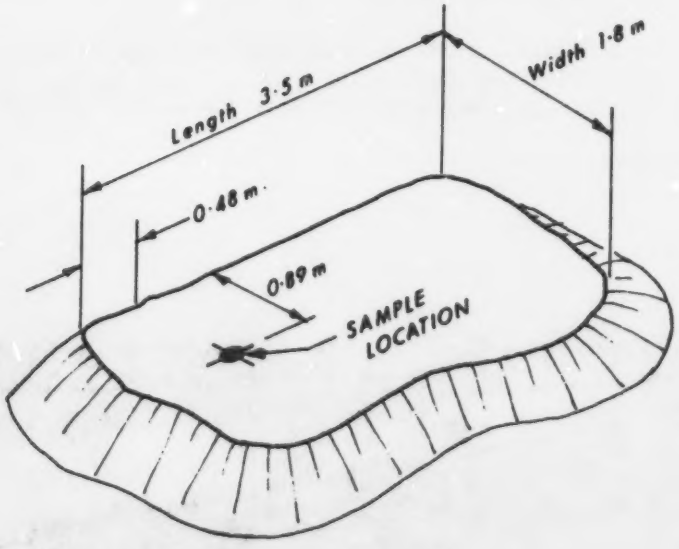
5.4 Delivery Sampling

Delivery sampling is carried out at the location where the trucks are being loaded from a stockpile or from a uniform pit face of Granular B Type 1 aggregate. Delivery samples should not be taken at those locations where Granular B aggregates are loaded directly from a variable pit face. It is realized that some judgement will be necessary by the Inspector in determining whether or not a pit face is uniform. If the Inspector feels that the gradation of the material is similar along the open pit face, he will assess the face as being uniform. Examples of uniform pit faces are predominantly sand deposits or stratified materials having horizontal layers of finer and coarser strata with no obvious silt layers. If, however, the open face of a pit exhibits irregular stratification with pockets, random seams and lenses of dissimilar material, the face will be deemed variable. In the latter case, road sampling should be chosen.

For delivery sampling, either the random time or the random quantity method may be used to select that portion of the aggregate to be sampled. The procedure for securing a delivery sample is as follows: As the selected truck is being loaded (in the case of random quantity) or at the random time (in the case of random time method), the operator of the front-end loader should place the next bucketful of material on the ground. The material is then levelled by blading it with the bucket so that the thickness of the levelled off aggregate is between 0.3 m and 0.5 m.

The levelled surface of the load is usually oblong in shape and somewhat irregular. Nevertheless, the actual location of the sample within the levelled surface should be decided by the random area method. Reworking of this load of material is not permitted.

Figure 2 shows a sketch indicating the above procedure.



Random Number		Sample Location
0.137 x 3.5	=	0.48 m
0.492 x 1.8	=	0.89 m

FIGURE 2

Obtain the sample from the location given by the random numbers by excavating the material as deep as possible with the tile spade, making sure that the sample is not mixed with the underlying material. Figure 3 is a photograph of delivery sampling.

FIGURE 3

5.5 Sampling Existing Stockpiles

Truly random samples cannot be obtained from a stockpile after it is built as only the surface can be sampled. Therefore, sampling for acceptance purposes for an existing stockpile should only be done under specific conditions. Samples for acceptance may be taken from stockpiles only if they contain 4 000 t of material or less. Larger stockpiles may be sampled only after subdividing to 4 000 t piles, or otherwise reworking the stockpile at the contractor's expense so that all the material has an equal probability of being sampled.

A stockpile of 4 000 t or less is considered as one lot. Each of the four quadrants of the stockpile is considered a sublot, and one sample is required from each. Samples should be obtained by excavating into the stockpile with a front-end loader, then dumping a load, blading it, and obtaining a sample from one random location of the spread load.

APPENDIX

RANDOM NUMBER TABLES

RANDOM NUMBER TABLES

784	.419	.496	.821	.029	.032	.851	.960	.006	.418
.078	.134	.763	.519	.842	.128	.383	.915	.743	.138
.323	.913	.378	.954	.315	.809	.298	.362	.277	.744
.950	.365	.675	.357	.110	.403	.153	.239	.273	.242
.264	.512	.245	.696	.111	.721	.822	.137	.537	.517
.418	.153	.931	.360	.730	.995	.307	.703	.617	.674
.424	.646	.172	.883	.676	.254	.699	.206	.630	.527
.617	.307	.543	.118	.235	.861	.615	.943	.327	.691
.844	.968	.716	.872	.770	.162	.293	.851	.130	.703
.214	.346	.047	.208	.831	.790	.761	.389	.625	.815
.687	.823	.611	.982	.545	.669	.481	.539	.074	.515
.640	.135	.262	.048	.246	.642	.491	.536	.295	.805
.256	.699	.012	.958	.190	.014	.661	.705	.760	.818
.193	.208	.957	.666	.284	.848	.260	.169	.763	.358
.071	.483	.274	.352	.549	.250	.320	.535	.933	.803
.612	.710	.710	.785	.884	.466	.981	.446	.219	.357
.410	.026	.354	.196	.556	.407	.389	.766	.981	.974
.541	.466	.682	.936	.644	.987	.064	.528	.711	.491
.860	.726	.295	.830	.430	.070	.963	.574	.436	.452
.625	.118	.645	.665	.430	.990	.164	.049	.808	.508
.486	.757	.554	.917	.543	.482	.711	.186	.494	.423
.874	.856	.764	.765	.820	.250	.879	.521	.445	.741
.285	.395	.786	.882	.667	.319	.162	.486	.895	.266
.596	.153	.584	.793	.635	.763	.378	.768	.059	.177
.271	.267	.181	.488	.585	.136	.884	.807	.809	.732
.020	.974	.241	.398	.582	.588	.899	.042	.770	.030
.359	.139	.213	.854	.283	.718	.828	.991	.143	.253
.668	.385	.911	.526	.261	.597	.523	.418	.057	.226
.203	.985	.708	.066	.749	.526	.803	.169	.513	.221
.258	.639	.093	.404	.285	.501	.079	.283	.185	.525
.644	.867	.172	.607	.406	.653	.099	.608	.710	.770
.507	.374	.038	.570	.671	.067	.558	.743	.155	.196
.841	.393	.553	.059	.459	.006	.047	.846	.151	.036
.717	.373	.823	.559	.457	.011	.701	.416	.370	.147
.226	.482	.964	.326	.278	.757	.233	.997	.784	.545
.757	.174	.421	.616	.834	.757	.174	.935	.985	.464
.013	.482	.264	.882	.766	.260	.730	.259	.591	.781
.321	.105	.571	.216	.842	.668	.061	.689	.339	.398
.929	.491	.517	.230	.065	.391	.069	.797	.735	.396
.430	.963	.270	.442	.715	.741	.113	.003	.627	.140

RANDOM NUMBER TABLES

.318	.801	.435	.202	.745	.489	.900	.027	.827	.279
.922	.683	.847	.320	.478	.421	.893	.825	.444	.619
.726	.473	.854	.662	.381	.761	.661	.868	.174	.799
.711	.341	.219	.228	.468	.683	.676	.374	.502	.469
.978	.631	.469	.885	.267	.510	.601	.135	.290	.025
.689	.152	.703	.544	.742	.335	.670	.034	.007	.590
.515	.351	.824	.856	.347	.792	.543	.590	.052	.713
.960	.690	.343	.019	.917	.879	.364	.271	.942	.355
.991	.520	.165	.043	.448	.626	.526	.926	.607	.827
.713	.766	.812	.496	.626	.770	.332	.770	.663	.200
.131	.266	.141	.916	.199	.510	.332	.546	.762	.991
.977	.697	.704	.305	.831	.740	.050	.926	.239	.392
.681	.627	.035	.023	.335	.790	.623	.673	.509	.480
.106	.702	.879	.408	.519	.929	.416	.584	.486	.818
.635	.427	.554	.288	.329	.933	.855	.858	.059	.851
.506	.672	.434	.162	.060	.375	.025	.415	.868	.637
.298	.057	.960	.411	.441	.565	.171	.693	.054	.065
.817	.663	.359	.038	.653	.001	.321	.506	.886	.920
.764	.580	.967	.071	.286	.351	.950	.098	.539	.793
.493	.205	.698	.182	.504	.687	.005	.814	.951	.326
.314	.496	.174	.924	.886	.170	.495	.431	.835	.546
.308	.360	.103	.151	.234	.927	.088	.981	.439	.444
.412	.097	.321	.233	.725	.434	.429	.919	.575	.493
.178	.245	.433	.486	.622	.175	.238	.108	.647	.215
.847	.387	.434	.285	.515	.980	.261	.980	.755	.058
.574	.039	.679	.471	.775	.986	.536	.834	.080	.754
.648	.461	.014	.064	.176	.867	.484	.794	.388	.890
.764	.412	.577	.523	.060	.329	.655	.313	.382	.134
.899	.070	.117	.270	.914	.048	.584	.566	.099	.314
.792	.356	.793	.143	.640	.267	.216	.824	.367	.886
.486	.886	.430	.327	.315	.988	.233	.880	.244	.936
.760	.328	.874	.960	.989	.426	.805	.934	.717	.880
.833	.122	.911	.217	.136	.907	.322	.090	.216	.392
.557	.997	.727	.181	.510	.704	.349	.505	.864	.872
.244	.180	.057	.721	.349	.629	.780	.065	.125	.721
.546	.572	.623	.347	.550	.472	.608	.325	.426	.001
.596	.533	.616	.678	.030	.197	.939	.806	.441	.212
.440	.559	.286	.750	.823	.928	.004	.225	.778	.384
.339	.388	.357	.764	.624	.170	.448	.564	.383	.310
.755	.918	.791	.329	.414	.149	.699	.172	.156	.482

RANDOM NUMBER TABLES

.511	.455	.333	.087	.021	.048	.265	.798	.430	.374
.941	.656	.537	.385	.994	.813	.012	.823	.502	.839
.673	.721	.637	.123	.748	.661	.372	.018	.242	.837
.623	.125	.748	.141	.648	.768	.933	.514	.969	.321

.498	.162	.692	.878	.474	.159	.751	.130	.691	.831
.732	.909	.181	.055	.139	.911	.113	.100	.178	.358
.336	.031	.853	.660	.417	.154	.051	.984	.881	.607
.652	.347	.261	.626	.778	.667	.321	.987	.404	.102

.815	.058	.941	.981	.743	.420	.400	.864	.713	.402
.567	.607	.476	.857	.120	.358	.313	.226	.091	.065
.651	.121	.116	.621	.112	.937	.329	.497	.328	.416
.380	.110	.905	.074	.450	.293	.238	.992	.534	.468

.117	.790	.119	.214	.868	.562	.163	.630	.185	.112
.386	.342	.174	.450	.134	.503	.421	.835	.608	.458
.871	.935	.699	.516	.937	.904	.437	.504	.300	.379
.967	.401	.487	.070	.959	.912	.706	.703	.431	.361

.035	.351	.251	.566	.125	.476	.495	.631	.705	.053
.334	.241	.075	.584	.618	.919	.359	.090	.157	.801
.742	.575	.022	.188	.241	.136	.120	.304	.561	.235
.589	.972	.148	.515	.674	.502	.173	.544	.131	.431

.091	.675	.899	.297	.987	.258	.286	.533	.642	.179
.562	.005	.040	.971	.491	.382	.840	.420	.762	.932
.923	.913	.114	.565	.031	.417	.264	.231	.543	.114
.153	.225	.585	.818	.598	.937	.325	.754	.250	.343

.931	.413	.108	.673	.879	.718	.801	.483	.575	.374
.284	.495	.328	.050	.197	.733	.718	.859	.893	.431
.138	.221	.286	.339	.248	.158	.591	.379	.621	.918
.982	.391	.054	.199	.991	.493	.254	.974	.456	.178

.306	.408	.069	.416	.208	.834	.753	.604	.272	.186
.460	.602	.941	.973	.348	.231	.451	.277	.759	.857
.059	.046	.022	.524	.259	.963	.079	.663	.293	.531
.754	.111	.174	.284	.215	.766	.693	.156	.265	.143

.239	.252	.479	.157	.946	.790	.880	.058	.983	.055
.478	.892	.979	.683	.718	.047	.944	.356	.696	.899
.387	.305	.192	.760	.795	.603	.858	.247	.561	.607
.513	.108	.897	.248	.626	.111	.871	.001	.614	.062

.580	.477	.887	.205	.082	.136	.443	.124	.352	.035
.032	.992	.035	.056	.788	.417	.131	.458	.439	.703
.971	.041	.621	.122	.836	.227	.858	.646	.895	.358
.372	.009	.854	.160	.125	.953	.619	.894	.985	.608

RANDOM NUMBER TABLES

.092	.502	.049	.381	.549	.243	.444	.452	.119	.192
.805	.944	.702	.129	.663	.270	.829	.540	.946	.525
.728	.859	.257	.970	.955	.673	.927	.822	.644	.516
.335	.051	.710	.238	.811	.991	.745	.243	.547	.498
.149	.691	.889	.776	.211	.860	.018	.985	.523	.489
.006	.289	.185	.946	.025	.619	.664	.704	.860	.479
.051	.206	.384	.330	.582	.994	.409	.716	.204	.891
.379	.402	.379	.476	.583	.728	.478	.631	.530	.603
.570	.483	.856	.249	.923	.026	.950	.275	.443	.306
.368	.126	.233	.335	.702	.430	.477	.006	.191	.102
.024	.508	.934	.501	.227	.881	.540	.966	.482	.745
.182	.288	.260	.738	.580	.300	.457	.931	.708	.900
.836	.497	.488	.924	.862	.302	.633	.124	.105	.245
.885	.589	.700	.510	.291	.489	.561	.570	.894	.478
.744	.180	.474	.667	.648	.251	.227	.740	.752	.099
.930	.961	.583	.718	.742	.809	.009	.948	.335	.133
.318	.138	.344	.401	.140	.459	.019	.536	.436	.971
.002	.190	.579	.781	.272	.641	.086	.353	.644	.136
.308	.517	.518	.136	.022	.613	.421	.492	.706	.406
.979	.504	.670	.660	.099	.363	.905	.853	.029	.035
.506	.758	.913	.095	.408	.324	.923	.238	.453	.286
.697	.839	.549	.878	.178	.538	.879	.774	.446	.714
.972	.473	.745	.188	.580	.738	.466	.214	.363	.928
.299	.216	.414	.370	.184	.080	.251	.251	.260	.741
.958	.863	.912	.012	.219	.201	.384	.291	.661	.633
.142	.784	.288	.910	.049	.644	.327	.345	.535	.310
.433	.412	.427	.996	.174	.318	.931	.006	.345	.263
.717	.976	.232	.083	.936	.094	.092	.391	.953	.688
.919	.370	.939	.575	.765	.539	.619	.308	.705	.829
.324	.637	.533	.659	.026	.617	.348	.218	.935	.463
.015	.004	.485	.594	.102	.942	.726	.295	.328	.489
.870	.204	.854	.547	.527	.552	.958	.454	.024	.689
.433	.152	.722	.656	.224	.358	.385	.667	.156	.647
.082	.502	.347	.393	.303	.295	.637	.307	.507	.689
.119	.057	.188	.474	.713	.138	.689	.004	.255	.903
.297	.713	.871	.658	.215	.353	.876	.045	.765	.864
.157	.625	.036	.503	.078	.692	.624	.003	.507	.793
.643	.307	.060	.358	.537	.842	.270	.356	.966	.279
.155	.229	.990	.097	.161	.265	.910	.277	.907	.218
.193	.218	.001	.810	.159	.401	.483	.175	.622	.374